APPENDIX I

CALIFORNIA HIGH SPEED RAIL: PCC—LIFE CYCLE ANALYSIS (MODAL ALTERNATIVE ADDITIONAL LANE MILES)

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California High Speed Rail: PCC—Life Cycle Analysis (Modal Alternative Additional Lane Miles)

- 40-Year Analysis Period
- All costs are for a one-lane mile
- Pavement shoulders and subgrade preparation are not included.
- Salvage value assumes that 10% of the capital cost of the PCC and LCB and 50% of the capital cost of the aggregate base remains after 40 years of service.
- 4.00 = Net Discount Rate (%)—Inflation rate equals 0

	Initial Capital Costs ($1000's)				Maintenance/Rehabilitation Costs ($1000's)								
Service Year	PCC	LCB	Aggregate Subbase Class 3	Σ	Level Grinding	Replace Joint Sealant	Replace 1% of Slab and Subbase	Engineering	Appurtenant & Supplemental Work	Traffic Delay	Detours	Total Present Value	Salvage Value ($1000's)
0				0	$0.3	$7.6	$12.3	$2.5	$2.7	$0.2	$0.6	26	
10					$0.3			$0.04	$0.04	$0.0	$0.0	0.3	
20					$0.3	$7.6	$12.3	$2.5	$2.7	$0.2	$0.6	12	
30					$0.3			$0.0	$0.0	$0.0	$0.0	0.1	
40					$0.3	$7.6	$12.3	$2.5	$2.7	$0.2	$0.6	5	0
Total				0							Total:	44	
											Total PCC Lane Miles:	1,990	
Summary											Total Cost (present Value)	87,531	

Item	Present Value ($1000's)
Initial Capital	–
Maintenance/Rehabilitation	87,531
Salvage*	–
Total	**87,531**

* 2970 freeway lane miles 33% AC (980) 67% PCC (1,990).

Sources: Parsons Brinckerhoff (2003)

California High Speed Rail: Asphalt Pavement—Life Cycle Analysis (Modal Alternative Additional Lane Miles)

- 40-Year Analysis Period
- All costs are for a one-lane mile
- Pavement shoulders and subgrade preparation are not included.
- Salvage value assumes that 10% of the capital cost of the asphalt remains after 40 years of service.
- 4.00 = Net Discount Rate (%)—Inflation rate equals 0

Initial Capital Costs ($1000's)							Maintenance/Rehabilitation Costs ($1000's)							
Service Year	RAC -OG	AC Type A	Aggregate Base Type 2	AC Type A 2% Voids	Σ	Crack Sealing in Asphalt Layers	Mill & Fill 1-inch of AC (10% of 1 lane mile)	Rebuild 2% of Pavement [asphalt only]	Engineering	Appurtenant & Supplemental Work	Traffic Delay	Detours	Total Present Value	Salvage Value ($1000's)
0			0		0	$2.3	$4.3	$12.3	$2.3	$2.5	$0.2	$0.6	24	
10						$2.3	$4.3		$0.8	$0.9	$0.1	$0.2	6	
20						$2.3	$4.3	$12.3	$2.3	$2.5	$0.2	$0.6	11	
30						$2.3	$4.3		$0.8	$0.9	$0.1	$0.2	3	
40						$2.3	$4.3	$12.3	$2.3	$2.5	$0.2	$0.6	5	0
Total					0							Total:	49	
												Total AC Lane Miles:	980	
Summary												Total Cost (present Value)	48,060	

Item	Present Value ($1000's)
Initial Capital	0
Maintenance/Rehabilitation	48,060
Salvage*	0
Total	48,060

* 2970 freeway lane miles 33% AC (980) 67% PCC (1,990)

Sources: Parsons Brinckerhoff (2003); 2002 Contract Cost Data, Caltrans 2002; RSMeans, Means Building Construction Cost Data 2002 Book, RSMeans 2002.

Maintenance Cost Estimate for HSR Highway Pavement Types

Quantity: 63,360 F^2 (One Lane Mile)

Pavement Option	Description	Quantity	Units of Measure		Subtotal cost	Unit Price	Total Cost
PCC Pavement Option							
1	Level grinding of pavement area[1]	634	ft^2			$0.52	$330
2	Remove & Replacement of joint sealant[2]	5,280	ft			$1.44	$7,590
3	Replacement of PCC, LCB, and subbase in 1% of the paved area	634	ft^2			$19	$12,262
	Saw Cut	79	lf	$3.25	$256		
	Demo Pavement	634	sqft	$2.50	$1,584		
	Excavate & Remove LCB & Subbase	23	cy	$15.00	$346		
	10 mile haul & Dispose of Demo	45	cy	$19.64	$892		
	Place & Compact LCB & Subbase (300 mm)	23	cy	$68.93	$1,592		
	Replace PCC Section (290 mm)	22	cy	$340.00	$7,591		
	Cut grooves	inc in PCC above					

Pavement Option	Description	Quantity	Units of Measure		Subtotal cost	Unit Price	Total Cost
Asphalt Pavement Option							
1	Sealing Random Cracks in Asphalt Layers[3]	1	ln mile			$2,270	$2,270
2	Mill and fill 10% of the upper 1-inch of the asphalt pavement section[4]	6,336	ft [2]			$0.67	$4,250
	Grinding 0.08 ft	6,336	ft [2]	$0.20	$1,260		
	binder (1.25 t/1,000sy)	0.88	tons	$158	$139		
	AC pea gravel	38	tons	$75	$2,851		
3	Rebuild of the asphalt concrete layers in 2% of the paved area	1,267	ft [2]			$10	$12,331
	Saw Cut	112	lf	$1.75	$195		
	Demo Pavement	1,267	sqft	$1.25	$1,584		
	Excavate & Remove LCB & Subbase	23	cy	$15.00	$346		
	10 mile haul & Dispose of Demo	58	cy	$19.64	$1,134		
	Place & Compact LCB & Subbase	0	cy	$68.93	$0		
	Replace AC Layer Type I	10	tons	$75.00	$725		
	Replace AC Layer Type II	87	tons	$75.00	$6,525		
	Replace AC Layer Type III	24	tons	$75.00	$1,821		

* Excludes traffic control or lane closures.
* Cost include premium for night/off-shift work.
* Costs exclude traffic striping, or delineators.
[1] based on per shift rate for deck grinding machine for profile Anrak assumes 1% grinding of section.
[2] Based on longitudinal premolded expansion joint.
[3] Based on one lane mile.
[4] Based on one lane mile.

Sources: Parsons Brinckerhoff (2003); 2002 Contract Cost Data, Caltrans 2002; RSMeans, Means Building Construction Cost Data 2002 Book, RSMeans 2002.